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The role of clothing on participation of persons with a physical disability: a scoping review protocol

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ABSTRACT

Introduction: Clothing is an important aspect of nearly all human societies from performing social and cultural functions to indicating social status, a form of protection and a way for self-expression. It can help or hinder the ability to fulfill everyday activities and social roles and with the rising industry of wearable technologies, smart textiles are adding health-monitoring functions to clothing. The influence that clothing can have on the life of someone with a physical disability is not trivial and further research is needed to understand it better. To achieve this, a scoping review will be performed with the aim of understanding the role of clothing on participation of individuals with a physical disability. This paper presents the protocol and procedure to be adopted.

Methods and analysis: An in-depth iterative analysis of the scientific literature from six databases (MEDLINE, Embase, CINAHL, Scopus, PsycINFO and ERIC) as well as a hand-search of grey literature and reference lists will be performed. After an abstract and full-text review of references by three reviewers independently, data from the selected articles will be tabulated and synthesized with a qualitative and quantitative approach using the International Classification of Functioning, Disability and Health (ICF) as a unifying conceptual framework. A multidisciplinary consultation group of experts from various stakeholder groups will be involved in multiple steps to ensure validation and relevance of the data.

Ethics and dissemination: As this is a review involving analysis of data available in the public domain and does not involve human participants, ethical approval was not required. Results will be presented in a co-constructed format with the expert consultation group to ensure validity and maximize its practicality moving forward. Our dissemination plan includes peer-reviewed publication, presentations and stakeholder meetings.

Strengths and Limitations of this study:

- Experts from each stakeholder group are actively engaged in the conception and validation of the study's method and results.
- The search strategy will include six databases covering the domains of rehabilitation, medicine, psychology and education as well as a wide range of grey literature sources.
- This study will be limited to publications in English and French and published within a specified period.
- As in other scoping reviews, there is no formal assessment of the quality of studies included.

INTRODUCTION

To wear clothing (i.e. fiber/textile material) is a custom of nearly all human societies. Besides fulfilling a range of social and cultural functions, clothing can be used to indicate social status and convey individual, occupational, and sexual differentiation. In many societies where individuals have the choice of what they wear, clothing can act as a form of adornment, and provide an expression of self, personal taste, and style. (1) More recently, the rise of technological industries has induced many innovative ideas towards modifying and adding function to everyday apparel. For example, wearable technology (i.e., smart/intelligent textiles) is now being used for sports training data acquisition and health monitoring of vital signs of the wearer (e.g., heart rate, respiration rate, temperature, activity, and posture). (2) In parallel to this emerging technological field, ideas within rehabilitation have also advanced whereby health professionals (service providers) and patients (service users) can play an equally important role in finding solutions or methods for managing the limitations of persons with a disability. Furthermore, global views towards rehabilitation have widened and factors of social inclusion and participation are strongly weighted. Undeniably, clothing is important in everyone's life; it can help or hinder the achievement of an individual's everyday activities and the fulfillment of social roles. With this understanding, the influential role clothing can have is not trivial in the life of someone with a disability.

The World Health Organization defines disability as an umbrella term for impairments, activity limitations, and participation restrictions. (3) Numerous health conditions, diagnosed or self-reported, can arise from mental, physical, cognitive, and other impairments in either a temporary or permanent state. One in seven people worldwide experience a disability, and with the aging population, as well as an increase in chronic conditions, this number continues to rise. (4) One of the many challenges in rehabilitation is that "living with disability is a process of constant change and constant adjustment". (5) Although independently, clothing design, wearable technologies and rehabilitation are fields that have grown

immensely over the years, there is a dearth of research at the point where they intersect. The application of textile enhancements or modifications has been well documented particularly in sports garments, however, it is unclear to what extent clothing can play a role on participation of persons with a physical disability. Moreover, the existing literature at the intersection of clothing and participation (defined below) appears to be too scattered to obtain a comprehensive portrayal of the underlying issues. Therefore, the authors propose using a scoping review as a systematic approach to address this topic.

Scoping studies have been presented as a way to comprehensively review the available literature covering a broad area of research, (6) such as clothing, participation and persons with a physical disability in this case. Furthermore, it is a quick and accessible way to study an under-researched domain with the function of keywords. The aim of this scoping review is to map, using the conceptual framework described below, the state of the knowledge (scope, depth, key themes and gaps) of the role of clothing (e.g., facilitators, barriers) on participation of people with a physical disability, as reported in the scientific and grey literature.

Conceptual Framework

The aim of the International Classification of Functioning, Disability and Health (ICF) published by the WHO in 2001 is to provide a unified and standard language and framework is to describe health and health-related states, such as, education and labour. Moreover, this framework highlights the "interactive relationship between health conditions and contextual factors" (p.6), (7) and allows professionals of varying disciplines (i.e., occupational therapy, fabrication industries, policy makers, researchers, general public, etc.) to communicate using a shared understanding and common language surrounding the field of functioning, disability and health. As our global health conditions increase in complexity, the ICF can facilitate more efficient and effective cross-discipline and cross-continent collaboration. The ICF is comprised of two parts: 1) Functioning and Disability, and 2) Contextual Factors, each of which have two components 1a) Body

Functions and Body Structures and, 1b) Activities and Participation and 2a) Environmental Factors and, 2b) Personal Factors. The first three components have several chapters and alphanumerical reference codes to assist in creating a systematic coding scheme across sectors, practices and countries. However, Personal Factors (i.e., gender, race, lifestyle, behavior, style) is "not classified in ICF because of the large social and cultural variances associated with them" (p.8). (3) Body Functions and Structures focus on the physiological functions and anatomical part of the body and its systems while Activities and Participation refer to the execution of a specific task or action in a standardized environment or the involvement of the individual in a life situation, respectively, from both an individual and societal perspective. The intended accent of this scoping review is to evaluate the category of Participation. This includes, for example, dressing, driving, cooking, etc., in one's natural (current) environment (i.e. home, community etc.). Although criticisms and ongoing propositions to improve the ICF exist, (8-10) the bio-psychosocial approach in the ICF is a step forward and serves as a promising and inclusive conceptual framework for research in rehabilitation. (11) For these reasons, the ICF will be used to provide structure (12) to the results of this scoping review.

METHODS AND ANALYSIS

This scoping review will follow the five-step methodological framework outlined by Arksey and O'Malley (6) and will add the optional sixth step proposed by Levac (13) primarily for methodological rigour. The six steps are defined as follows: 1) Identifying the research question, 2) Identifying relevant studies, 3) Study selection, 4) Charting the data, 5) Collecting, summarizing and reporting the results, and 6) Consultation. The specifics of how each step will be undertaken in the context of this research topic are explained below.

Step One: Identifying the Research Question

Although the explorative nature of a scoping review allows the research question to be modified throughout its subsequent steps, a well-defined starting point is

necessary. The following research question was established: *What is the role of clothing on participation among persons with a physical disability?* This research question will continue to be refined as the authors become more informed on the state of the literature and as potential nuances arise.

Step Two: Identifying Relevant Studies

This research topic spans multiple areas of interest such as, rehabilitation, education, psychology, and design. In order to map a comprehensive picture of this multidisciplinary literature, the research strategy will remain inclusive. As a result, six databases were identified (MEDLINE, Embase, CINAHL, Scopus, PsycINFO and ERIC) with the help of a university librarian with expertise in the field of rehabilitation and will be searched for relevant scientific articles. Adapted clothing and wearable technologies are relatively new concepts and have only recently made it into the research and societal vocabulary. Moreover, technological advances quickly outdate their predecessors. Therefore, a restriction of literature dating between 1990 and 2017 will be applied to allow for ample room in finding past studies whilst staying relevant to the needs, challenges and resources available to today's society. In addition to the six research databases, a hand search of grey literature and reference lists will also be performed. Grey literature will be collected by specifying a date on which a Google search will be performed using similar keywords as used with the scientific databases. The first four pages of this search, as well as any materials collected from team members up until a pre-determined date, will be considered. Both English and French publications will be retained as inclusion criteria since the authors are proficient in both languages. Nevertheless, we acknowledge that filtering out other languages will be a limitation of the study.. Our study targets individuals 14 years and older therefore, literature involving children (<14 years) will be omitted. Clothing choices and dressing of younger children may also involve parents, which could be subject for another review. Keywords covering variations of "physical disability" and "clothing" will be used. In the event that an unreasonable amount of non-pertinent articles are retrieved, the keywords will be re-assessed and modified accordingly.

Although 'participation' is in the ICF nomenclature, the scientific literature has not yet completely adopted this terminology. As such, and in order to be more inclusive and to avoid excluding pertinent articles, this keyword will not be included in the initial database searches but introduced in steps four and five of the scoping review. The specific search strategy for each database will be defined in accordance with the above inclusion criteria and with the assistance of the same university librarian. All terms will be searched in the title, abstract, and keywords (where applicable) fields for each database.

Step Three: Study Selection

The process of selecting articles to include in the final results of the scoping review will take place over three stages: duplicate management, title and abstract review, and full-text review. In accordance with the iterative nature of a scoping review, if any clarifications made at one of the three study-selection stages have an effect at a later stage, the authors will return and re-review as necessary to ensure compliance. Firstly, all references will be imported and merged using reference managing software (Endnote X7.7.1). After flagging and removing duplicates, A.E., B.S. and F.P (co-authors) will each review one third of all titles and abstracts for relevance. In the case of any uncertainties, a discussion amongst authors will be conducted until a consensus is reached. After all titles and abstracts are either accepted or rejected, a process of retrieving and reviewing the full texts will be undertaken. At the full text review stage, ten to 20 articles at a time will be distributed to each author in a way that two authors review each article. Similar to the abstract review stage, each author will independently rate the article as accepted, rejected or unsure if it aligns or does not align with the research question and the defined selection criteria. Once completed, the authors will meet and discuss their choices, clarify any discrepancies, and adjust the inclusion and exclusion criteria as necessary. Before discussions, a kappa (κ) statistic will be calculated for each pair of the authors' reviews to statistically estimate inter-rater agreement. This process of reviewing articles and group discussions will continue until the authors are confident in the selection criteria and a mean $\kappa > .75$ is

reached (.40< κ >.59= fair, .60< κ >.74= good, κ>.75= excellent agreement). (14) After which, A.E. will be the sole reviewer on the remaining full-text articles.

Step Four: Charting the Data

Data from the accepted articles after the full-text review stage will be extracted and tabulated into categories that best reflect the important information in relation to the research question. An initial data extraction form will be developed using the concepts, language, and when useful, codes determined from the ICF. Basic categories such as, authors and year of publication, type of study, aim of study, type and number of participants, and type of clothing will also be included. Borrowing from step three of the scoping review, this data extraction form will be used by two authors independently commencing with a proportion (about 10%) of the articles followed by group discussions which will allow for an evaluation and validation of the data extraction methods, or more specifically, the data extraction form. The extraction form is anticipated to evolve as articles are read and categories will be added, removed and/or adjusted as necessary.

Step Five: Collecting, Summarizing and Reporting the Results

Aggregating and conveying findings is the crux of a scoping review whereby the results are linked to broader implications and have tangible meaning for future research, policy and practice. (13) As specified in the aim of this study, the scope, depth, key themes and gaps in the literature about the role of clothing on participation of persons with a physical disability will be the main focus of this step. Inspired by Arksey and O'Malley (6), a framework with both quantitative and qualitative metrics will be presented. Quantitative analyses will include a numerical description of the year of publication, study designs, study populations, type of clothing (e.g. footwear, undergarments, winter coats), targeted (or not) ICF categories, and others. By looking at these frequencies alone, certain gaps in the literature can be determined, however, it may be inadequate for understanding the complete picture. Therefore, a thematic analysis using the ICF as a basis will be a qualitative addition and enable us to illustrate the multi-directional relationship

between health and health-related domains and clothing design. Furthermore, it will provide a better understanding of the dynamic interaction that exists at the junction between contextual factors (i.e., environment and personal) and their influence on clothing. By presenting the scoping review results through quantitative and qualitative means a faithful overview of the literature will be reported.

Step Six: Consultation

The consultation team used in this study is comprised of twelve professionals spanning various sectors (i.e., health, design, manufacturing industry, health technology, rehabilitation, psychology). The team brings together six researchers, three representatives from the fashion industry (new technology, design, business development, innovation), two post-doctoral fellows, and an active person living with a spinal cord injury. The team's expertise covers research in occupational therapy, physiotherapy, capturing end-user needs related to rehabilitation technology, knowledge of scoping reviews, psychology and behaviour, understanding of social participation and quality of life of all age groups, innovative design processes and product development, smart textiles, and intervention evaluation. Experience with a variety of research methods also exists within the team, namely, qualitative, quantitative, personal experience and use of the ICF. In addition, each individual was brought together for his or her unique stakeholder perspective related to this research topic.

Although Levac (13) proposes the consultation step as a necessary final step, when designing this study the authors considered it imperative for the expert consultation team to be integrated at multiple points throughout the process due to the originality of the subject and limited research performed to date. A schematic overview of the methodology for this scoping review can be seen in Figure 1. Three time points were pinpointed for consultation: Step One- Identifying the Research Question, Step Four- Charting the Data and Step Six- Consultation. The goal of the first consultation was to create an initial research question that could be

understood by and respond to all sectors involved (i.e., rehabilitation, industry, customer). The goal of the second consultation will be to validate the correct placement of data extracted from articles into the ICF categories in the data extraction form. The final step of the scoping review is a synthesis of knowledge either as recommendations or another suitable format for future research, for clinical practice and/or for design principles. The goal of the last consultation will be to validate the results and co-construct the final document for dissemination. This integrated study design will enable the results to be translated into a worthwhile medium for all stakeholders surrounding this specific research question. For example, these results could inform the design of future clothing and ultimately improve the participation of persons with a physical disability.

ETHICS AND DISSEMINATION

Institutional ethics approval is unnecessary for the secondary analysis of published literature and consultations will occur by means of informal exchanges in person and electronically within the research team. The scoping study results will be disseminated in the context of local, national and international activities. These activities may include but are not limited to, conferences, published articles, events in academic and non-academic settings, and by means of the multidisciplinary research/consultation team to the appropriate knowledge users (e.g., clinicians, clothing designers, etc.).

CONCLUSION

The scoping review protocol outlined in this paper will bring together various sources of knowledge about the role of clothing on participation of persons with a physical disability. The standardized language and conceptual framework provided by the ICF will tie together the sparse and varied literature and help identify the scope, depth, key themes and gaps that exist. This meaningful synthesis dissemination of the literature will pave the way for future research and establish next steps in each of the stakeholder groups for this emerging and underrepresented field.

Authors' Contributions

A.E. drafted the manuscript. F.P., A.R., C.A., C.B., E.d.G., I.D., E.K., D.L., N.D-O., I.L., O.V. and B.S. conceived and designed the study and read and approved the final manuscript. A.E, F.P. and B.S. will perform Steps 1-3 of the scoping review. A.E., A.R., C.A. and B.S. will perform Steps 4-5. All authors will contribute to the consultations in Step 6.

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Competing Interests

The authors declare no conflicts of interest.

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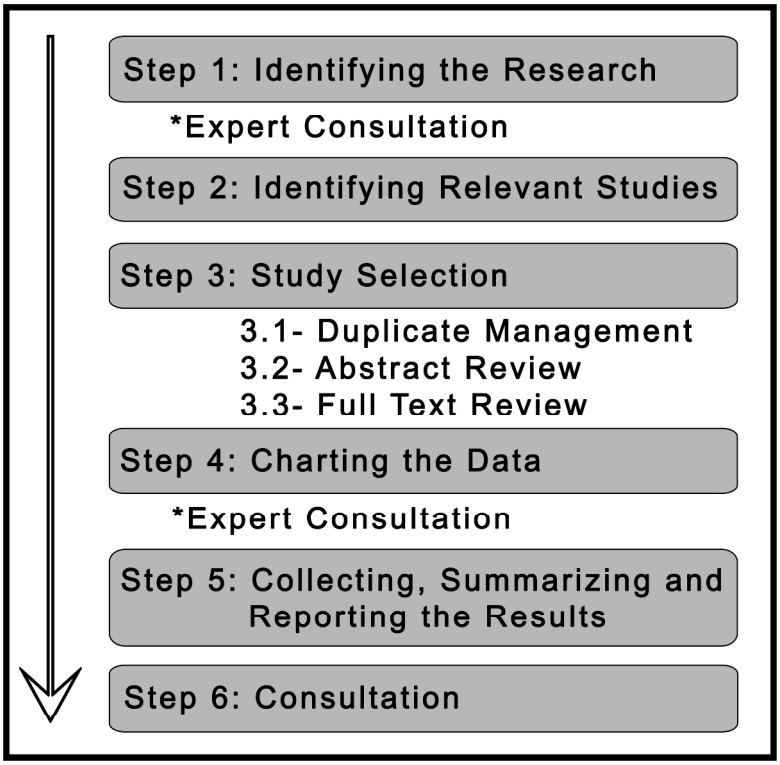

Figure 1: Overview of the Methodology

Overview of the Methodology

276x276mm (300 x 300 DPI)

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Scoping studies have been presented as a way to comprehensively review the available literature covering a broad area of research, (6) such as clothing, participation and persons with a physical disability in this case. Furthermore, it is a quick and accessible way to study an under-researched domain with the function of keywords. The aim of this scoping review is to map, using the conceptual framework described below, the state of the knowledge (scope, depth, key themes and gaps) of the role of clothing (e.g., facilitators, barriers) on participation of people with a physical disability, as reported in the scientific and grey literature.

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The aim of the International Classification of Functioning, Disability and Health (ICF) published by the WHO in 2001 is to provide a unified and standard language and framework, and to describe health and health-related states such as education and labour. Moreover, this framework highlights the "interactive relationship between health conditions and contextual factors" (p.6), (7) and allows professionals of varying disciplines (i.e., occupational therapy, fabrication industries, policy makers, researchers, general public, etc.) to communicate using a shared understanding and common language surrounding the field of functioning, disability and health. As our global health conditions increase in complexity, the ICF can facilitate more efficient and effective cross-discipline and cross-continent collaboration. The ICF is comprised of two parts: 1) Functioning and Disability, and 2) Contextual Factors, each of which have two components 1a) Body

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exclusion criteria as necessary. Before discussions, a kappa (κ) statistic will be calculated for each pair of the authors' reviews to statistically estimate inter-rater agreement. This process of reviewing articles and group discussions will continue until the authors are confident in the selection criteria and a mean $\kappa > .75$ is reached ($.40 < \kappa > .59$= fair, $.60 < \kappa > .74$= good, $\kappa > .75$= excellent agreement). (14) After which, A.E. will be the sole reviewer on the remaining full-text articles.

Step Four: Charting the Data

Data from the accepted articles after the full-text review stage will be extracted and tabulated into categories that best reflect the important information in relation to the research question. An initial data extraction form will be developed using the concepts, language, and when useful, codes determined from the ICF. Basic categories such as, authors and year of publication, type of study, aim of study, type and number of participants, and type of clothing will also be included. Borrowing from step three of the scoping review, this data extraction form will be used by two authors independently commencing with a proportion (about 10%) of the articles followed by group discussions which will allow for an evaluation and validation of the data extraction methods, or more specifically, the data extraction form. The extraction form is anticipated to evolve as articles are read and categories will be added, removed and/or adjusted as necessary.

Step Five: Collecting, Summarizing and Reporting the Results

Aggregating and conveying findings is the crux of a scoping review whereby the results are linked to broader implications and have tangible meaning for future research, policy and practice. (13) As specified in the aim of this study, the scope, depth, key themes and gaps in the literature about the role of clothing on participation of persons with a physical disability will be the main focus of this step. Inspired by Arksey and O'Malley (6), a framework with both quantitative and qualitative metrics will be presented. Quantitative analyses will include a numerical description of the year of publication, study designs, study populations, type of clothing (e.g. footwear, undergarments, winter coats), targeted (or not) ICF

categories, and others. By looking at these frequencies alone, certain gaps in the literature can be determined, however, it may be inadequate for understanding the complete picture. Therefore, a thematic analysis using the ICF as a basis will be a qualitative addition and enable us to illustrate the multi-directional relationship between health and health-related domains and clothing design. Furthermore, it will provide a better understanding of the dynamic interaction that exists at the junction between contextual factors (i.e., environment and personal) and their influence on clothing. By presenting the scoping review results through quantitative and qualitative means a faithful overview of the literature will be reported.

Step Six: Consultation

The consultation team used in this study is comprised of twelve professionals spanning various sectors (i.e., health, design, manufacturing industry, health technology, rehabilitation, psychology). The team brings together six researchers, three representatives from the fashion industry (new technology, design, business development, innovation), two post-doctoral fellows, and an active person living with a spinal cord injury. The team's expertise covers research in occupational therapy, physiotherapy, capturing end-user needs related to rehabilitation technology, knowledge of scoping reviews, psychology and behaviour, understanding of social participation and quality of life of all age groups, innovative design processes and product development, smart textiles, and intervention evaluation. Experience with a variety of research methods also exists within the team, namely, qualitative, quantitative, personal experience and use of the ICF. In addition, each individual was brought together for his or her unique stakeholder perspective related to this research topic.

Although Levac (13) proposes the consultation step as a necessary final step, when designing this study the authors considered it imperative for the expert consultation team to be integrated at multiple points throughout the process due to the originality of the subject and limited research performed to date. A schematic

overview of the methodology for this scoping review can be seen in Figure 1. Three time points were pinpointed for consultation: Step One- Identifying the Research Question, Step Four- Charting the Data and Step Six- Consultation. The goal of the first consultation was to create an initial research question that could be understood by and respond to all sectors involved (i.e., rehabilitation, industry, customer). The goal of the second consultation will be to validate the correct placement of data extracted from articles into the ICF categories in the data extraction form. The final step of the scoping review is a synthesis of knowledge either as recommendations or another suitable format for future research, for clinical practice and/or for design principles. The goal of the last consultation will be to validate the results and co-construct the final document for dissemination. This integrated study design will enable the results to be translated into a worthwhile medium for all stakeholders surrounding this specific research question. For example, these results could inform the design of future clothing and ultimately improve the participation of persons with a physical disability.

ETHICS AND DISSEMINATION

Institutional ethics approval is unnecessary for the secondary analysis of published literature and consultations will occur by means of informal exchanges in person and electronically within the research team. The scoping study results will be disseminated in the context of local, national and international activities. These activities may include but are not limited to, conferences, published articles, events in academic and non-academic settings, and by means of the multidisciplinary research/consultation team to the appropriate knowledge users (e.g., clinicians, clothing designers, etc.).

CONCLUSION

The scoping review protocol outlined in this paper will bring together various sources of knowledge about the role of clothing on participation of persons with a physical disability. The standardized language and conceptual framework provided by the ICF will tie together the sparse and varied literature and help identify the

scope, depth, key themes and gaps that exist. This meaningful synthesis dissemination of the literature will pave the way for future research and establish next steps in each of the stakeholder groups for this emerging and underrepresented field.

Authors' Contributions

A.E. drafted the manuscript. F.P., A.R., C.A., C.B., E.d.G., I.D., E.K., D.L., N.D-O., I.L., O.V. and B.S. conceived and designed the study and read and approved the final manuscript. A.E, F.P. and B.S. will perform Steps 1-3 of the scoping review. A.E., A.R., C.A. and B.S. will perform Steps 4-5. All authors will contribute to the consultations in Step 6.

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Competing Interests

The authors declare no conflicts of interest.

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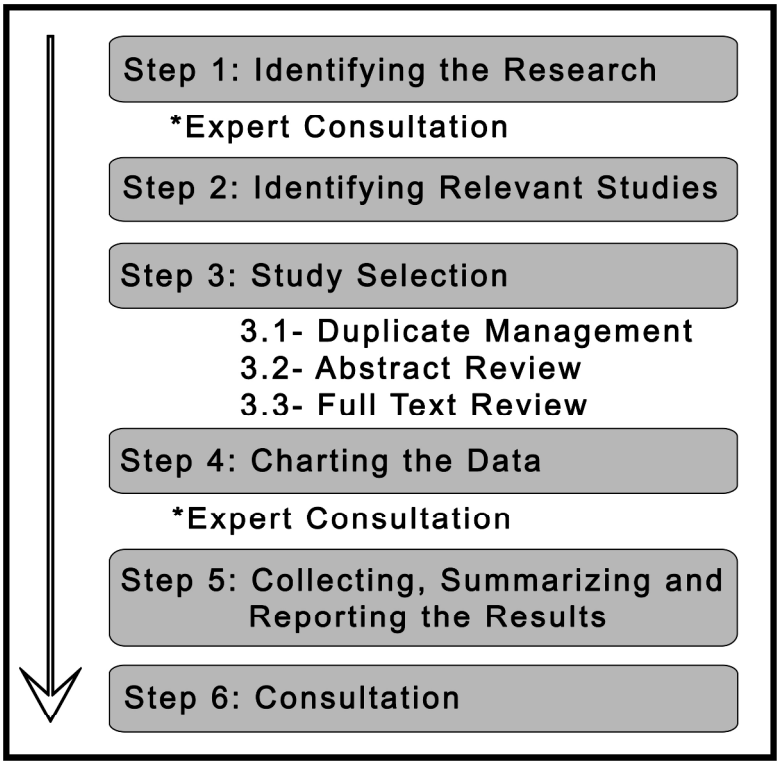
Figure 1: Overview of the methodology



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276x276mm (300 x 300 DPI)

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The role of clothing on participation of persons with a physical disability: a scoping review protocol

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AUTHORS: Alida Esmail[1,2], Frédérique Poncet[2,3,4], Annie Rochette[1,2], Claudine Auger[1,2], Christophe Billebaud[5,6], Élaine de Guise[2,7], Isabelle Ducharme[8], Eva Kehayia[2,9], Delphine Labbé[10], Noémi Dahan-Oliel[9,11], Isabelle Lessard[12], Olivier Vermeersch[13] & Bonnie Swaine[1,2]

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ABSTRACT

Introduction: Clothing is an important aspect of nearly all human societies from performing social and cultural functions to indicating social status, a form of protection and a way for self-expression. It can help or hinder the ability to fulfill everyday activities and social roles and with the rising industry of wearable technologies, smart textiles are adding health-monitoring functions to clothing. The influence that clothing can have on the life of someone with a physical disability is significant and further research is needed to understand it better. To achieve this, a scoping review will be performed with the aim of understanding the role of clothing on participation (i.e. at home, in the community, etc.) of individuals with a physical disability. This paper presents the protocol and procedure to be adopted.

Methods and analysis: An in-depth iterative analysis of the scientific literature from six databases (MEDLINE, Embase, CINAHL, Scopus, PsycINFO and ERIC) as well as a hand-search of grey literature and reference lists will be performed. After an abstract and full-text review of references by three reviewers independently, data from the selected articles will be tabulated and synthesized with a qualitative and quantitative approach using the International Classification of Functioning, Disability and Health (ICF) as a unifying conceptual framework. A multidisciplinary consultation group of experts from various stakeholder groups will be involved in multiple steps to ensure validation and relevance of the data.

Ethics and dissemination: As this is a review involving analysis of data available in the public domain and does not involve human participants, ethical approval was not required. Results will be presented in a co-constructed format with the expert consultation group to ensure validity and maximize its practicality moving forward. Our dissemination plan includes peer-reviewed publication, presentations and stakeholder meetings.

Strengths and Limitations of this study:

- Experts from each stakeholder group are actively engaged in the conception and validation of the study's method and results.
- The search strategy will include six databases covering the domains of rehabilitation, medicine, psychology and education as well as a wide range of grey literature sources.
- This study will be limited to publications in English and French and published within a specified period.
- As in other scoping reviews, there is no formal assessment of the quality of studies included.

INTRODUCTION

To wear clothing (i.e. fiber/textile material) is a custom of nearly all human societies. Besides fulfilling a range of social and cultural functions, clothing can be used to indicate social status and convey individual, occupational, and sexual differentiation. In many societies where individuals have the choice of what they wear, clothing can act as a form of adornment, and provide an expression of self, personal taste, and style. (1) More recently, the rise of technological industries has induced many innovative ideas towards modifying and adding function to everyday apparel. For example, wearable technology (i.e., smart/intelligent textiles) is now being used for sports training data acquisition and health monitoring of vital signs of the wearer (e.g., heart rate, respiration rate, temperature, activity, and posture). (2) In parallel to this emerging technological field, ideas within rehabilitation have also advanced whereby service providers and service users can play equally important roles in finding solutions or methods for persons with a disability to experience a more positive day-to-day life. Furthermore, society also has a role in optimizing social inclusion and participation for people with a physical disability (e.g. changing attitudes, eliminating barriers, enhancing acceptance). Undeniably, clothing is important in everyone's life; it can help or hinder the achievement of an individual's everyday activities and the fulfillment of social roles. With this understanding, the influential role clothing can have is significant in the life of someone with a disability.

The World Health Organization defines disability as an umbrella term for impairments, activity limitations, and participation restrictions. (3) Numerous health conditions, diagnosed or self-reported, can arise from mental, physical, cognitive, and other impairments in either a temporary or permanent state. One in seven people worldwide experience a disability, and with the aging population, as well as an increase in chronic conditions, this number continues to rise. (4) One of the many challenges in rehabilitation is that "living with disability is a process of constant change and constant adjustment". (5) Although independently, clothing design, wearable technologies and rehabilitation are fields that have grown

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Step Three: Study Selection

The process of selecting articles to include in the final results of the scoping review will take place over three stages: duplicate management, title and abstract review, and full-text review. In accordance with the iterative nature of a scoping review, if any clarifications made at one of the three study-selection stages have an effect at a later stage, the authors will return and re-review as necessary to ensure compliance. Firstly, all references will be imported and merged using reference managing software (Endnote X7.7.1). After flagging and removing duplicates, A.E., B.S. and F.P (co-authors) will each review one third of all titles and abstracts for relevance. In the case of any uncertainties, a discussion amongst authors will be conducted until a consensus is reached. After all titles and abstracts are either accepted or rejected, a process of retrieving and reviewing the full texts will be undertaken. At the full text review stage, ten to 20 articles at a time will be distributed to each author in a way that two authors review each article. Similar to the abstract review stage, each author will independently rate the article as accepted, rejected or unsure if it aligns or does not align with the research question

and the defined selection criteria. Once completed, the authors will meet and discuss their choices, clarify any discrepancies, and adjust the inclusion and exclusion criteria as necessary. Before discussions, a kappa (κ) statistic will be calculated for each pair of the authors' reviews to statistically estimate inter-rater agreement. This process of reviewing articles and group discussions will continue until the authors are confident in the selection criteria and a mean $\kappa > .75$ is reached ($.40< \kappa >.59$= fair, $.60< \kappa >.74$= good, $\kappa>.75$= excellent agreement). (14) After which, A.E. will be the sole reviewer on the remaining full-text articles.

Step Four: Charting the Data

Data from the accepted articles after the full-text review stage will be extracted and tabulated into categories that best reflect the important information in relation to the research question. An initial data extraction form will be developed using the concepts, language, and when useful, codes determined from the ICF. Basic categories such as, authors and year of publication, type of study, aim of study, type and number of participants, and type of clothing will also be included. Borrowing from step three of the scoping review, this data extraction form will be used by two authors independently commencing with a proportion (about 10%) of the articles followed by group discussions which will allow for an evaluation and validation of the data extraction methods, or more specifically, the data extraction form. The extraction form is anticipated to evolve as articles are read and categories will be added, removed and/or adjusted as necessary.

Step Five: Collecting, Summarizing and Reporting the Results

Aggregating and conveying findings is the crux of a scoping review whereby the results are linked to broader implications and have tangible meaning for future research, policy and practice. (13) As specified in the aim of this study, the scope, depth, key themes and gaps in the literature about the role of clothing on participation of persons with a physical disability will be the main focus of this step. Inspired by Arksey and O'Malley (6), a framework with both quantitative and qualitative metrics will be presented. Quantitative analyses will include a

numerical description of the year of publication, study designs, study populations, type of clothing (e.g. footwear, undergarments, winter coats), targeted (or not) ICF categories, and others. By looking at these frequencies alone, certain gaps in the literature can be determined, however, it may be inadequate for understanding the complete picture. Therefore, a thematic analysis using the ICF as a basis will be a qualitative addition and enable us to illustrate the multi-directional relationship between health and health-related domains and clothing design. Furthermore, it will provide a better understanding of the dynamic interaction that exists at the junction between contextual factors (i.e., environment and personal) and their influence on clothing. By presenting the scoping review results through quantitative and qualitative means a faithful overview of the literature will be reported.

Step Six: Consultation

The consultation team used in this study is comprised of twelve professionals spanning various sectors (i.e., health, design, manufacturing industry, health technology, rehabilitation, psychology). The team brings together six researchers, three representatives from the fashion industry (new technology, design, business development, innovation), two post-doctoral fellows, and an active person living with a spinal cord injury. The team's expertise covers research in occupational therapy, physiotherapy, capturing end-user needs related to rehabilitation technology, knowledge of scoping reviews, psychology and behaviour, understanding of social participation and quality of life of all age groups, innovative design processes and product development, smart textiles, and intervention evaluation. Experience with a variety of research methods also exists within the team, namely, qualitative, quantitative, personal experience and use of the ICF. In addition, each individual was brought together for his or her unique stakeholder perspective related to this research topic.

Although Levac (13) proposes the consultation step as a necessary final step, when designing this study the authors considered it imperative for the expert consultation

team to be integrated at multiple points throughout the process due to the originality of the subject and limited research performed to date. A schematic overview of the methodology for this scoping review can be seen in Figure 1. Three time points were pinpointed for consultation: Step One- Identifying the Research Question, Step Four- Charting the Data and Step Six- Consultation. The goal of the first consultation was to create an initial research question that could be understood by and respond to all sectors involved (i.e., rehabilitation, industry, customer). The goal of the second consultation will be to validate the correct placement of data extracted from articles into the ICF categories in the data extraction form. The final step of the scoping review is a synthesis of knowledge either as recommendations or another suitable format for future research, for clinical practice and/or for design principles. The goal of the last consultation will be to validate the results and co-construct the final document for dissemination. This integrated study design will enable the results to be translated into a worthwhile medium for all stakeholders surrounding this specific research question. For example, these results could inform the design of future clothing and ultimately improve the participation of persons with a physical disability.

ETHICS AND DISSEMINATION

Institutional ethics approval is unnecessary for the secondary analysis of published literature and consultations will occur by means of informal exchanges in person and electronically within the research team. The scoping study results will be disseminated in the context of local, national and international activities. These activities may include but are not limited to, conferences, published articles, events in academic and non-academic settings, and by means of the multidisciplinary research/consultation team to the appropriate knowledge users (e.g., clinicians, clothing designers, etc.).

CONCLUSION

The scoping review protocol outlined in this paper will bring together various sources of knowledge about the role of clothing on participation of persons with a

physical disability. The standardized language and conceptual framework provided by the ICF will tie together the sparse and varied literature and help identify the scope, depth, key themes and gaps that exist. This meaningful synthesis dissemination of the literature will pave the way for future research and establish next steps in each of the stakeholder groups for this emerging and underrepresented field.

Authors' Contributions

A.E. drafted the manuscript. F.P., A.R., C.A., C.B., E.d.G., I.D., E.K., D.L., N.D-O., I.L., O.V. and B.S. conceived and designed the study and read and approved the final manuscript. A.E, F.P. and B.S. will perform Steps 1-3 of the scoping review. A.E., A.R., C.A. and B.S. will perform Steps 4-5. All authors will contribute to the consultations in Step 6.

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Competing Interests

The authors declare no conflicts of interest.

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Figure 1: Overview of the methodology

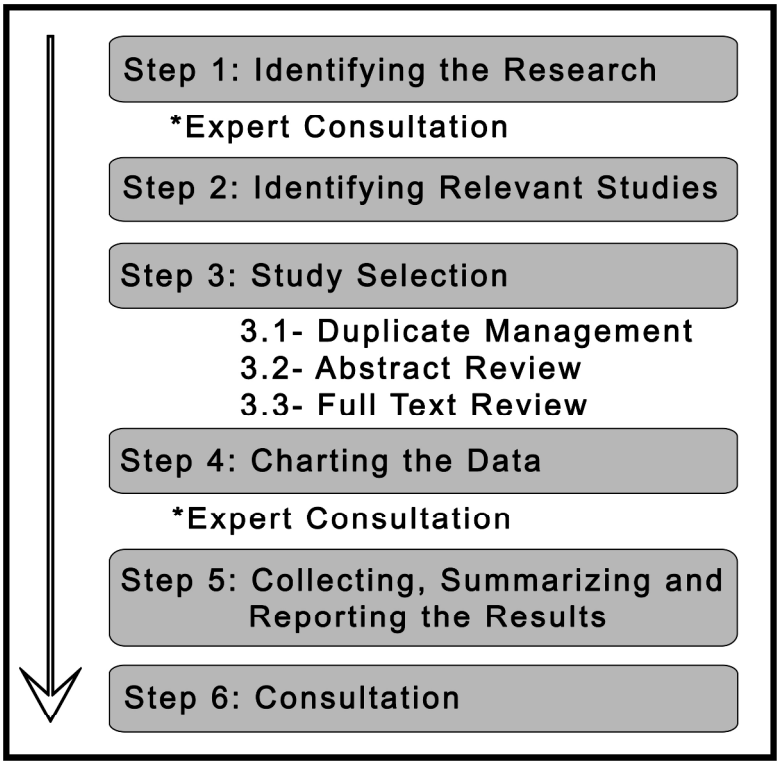

Figure 1: Overview of the Methodology

Overview of the Methodology

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